International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 04 | April - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

STUDY OF BRTS CORRIDOR IN NASHIK

Pranav Raut[1] , Pooja Jadhav[2] , Prof. P. R. Shelar[3]
[1,2] Student of B.E. Civil at Sanghavi College Of Engineering, Nashik, Maharashtra, India
[3]Assistant Professor, Department of Civil Engineering, Sanghavi College Of Engineering, Nashik, Maharashtra, India.

----------***----------

Abstract –
Over the past century, Nashik has experienced remarkable population growth, expanding from 21,940 residents in 1901 to approximately 18 lakhs today. This growth rate surpasses that of any other city in Maharashtra, making Nashik the fourth largest in terms of population. Situated along the Delhi – Mumbai Industrial Corridor and part of Maharashtra's Golden Triangle project, Nashik plays a pivotal role in India's economic landscape. However, this rapid expansion has strained the city's transportation infrastructure, leading to congestion and safety concerns. The current road network, including national and state highways, struggles to accommodate the increasing volume of vehicles, hindering efficient movement. Moreover, inadequate provisions for pedestrians and cyclists exacerbate these challenges.

To address these issues and foster sustainable development, there is a pressing need for a comprehensive transportation system that caters to all stakeholders, including motorists, cyclists, pedestrians, and heavy vehicle operators. Sustainable transport aims to minimize environmental impact and social costs, emphasizing modes of transport that reduce emissions and promote efficiency. Recognizing the importance of sustainable urban transport, the Indian government has initiated various measures, including the formulation of the National Urban Transport Policy (NUTP) and the promotion of clean development mechanisms. However, significant improvements in both road and rail-based mass transit systems are still required to meet the growing demands of Nashik's population.

This study aims to assess the current transport infrastructure in Nashik and explore alternative solutions for public transportation, non-motorized transport, traffic management, and pedestrian safety. With the government's emphasis on developing smart cities, Nashik's transportation system must evolve to accommodate the needs of its residents while minimizing environmental impact and enhancing overall quality of life.

1.INTRODUCTION

1.1 Current scenario and status of traffic:

Nashik, a city in Maharashtra, India, has undergone significant demographic shifts over the past century, emerging as one of the key urban centers in the region. From its modest population of 21,940 in 1901, Nashik has experienced exponential growth, reaching approximately 18 lakhs today. This growth trajectory outpaces that of any other city in Maharashtra, positioning Nashik as the fourth largest city by population. Strategically located along the Delhi – Mumbai Industrial Corridor (DMIC) and a vital participant in Maharashtra's Golden Triangle project, Nashik plays a pivotal role in India's economic landscape. Its connectivity to major cities via national highways, including Mumbai Agra road (National Highway No.3) and Pune (National Highway No.50), as well as its robust railway network, underscores its importance as a transportation hub.

However, Nashik's rapid expansion has strained its transportation infrastructure. The city's roads, designed to accommodate a much smaller population, now struggle with congestion and inadequate provisions for pedestrians and cyclists. This situation is exacerbated by the increasing volume of motor vehicles, cycles, and pedestrians, propelled by a high rate of industrial

development.Recognizing the urgent need for sustainable urban transport, the Indian government has initiated measures such as the National Urban Transport Policy (NUTP) to promote environmentally friendly modes of transportation and alleviate congestion. Despite these efforts, Nashik faces significant challenges in upgrading its road and rail-based mass transit systems to meet the needs of its burgeoning population.

In light of these challenges, this study aims to assess Nashik's current transportation infrastructure and propose alternative solutions for public transportation, non-motorized transport, traffic management, and pedestrian safety. As the government emphasizes the development of smart cities, Nashik must evolve its transportation system to accommodate the needs of its residents while minimizing environmental impact and enhancing overall quality of life.Furthermore, recent developments underscore the pressing need for urban interventions to address congestion, pollution, and safety concerns. Nashik stands at a critical juncture in its development, with the opportunity to become a model city for sustainable urban living. However, achieving this vision requires concerted efforts to improve infrastructure and services, ensuring a high quality of life for all residents, regardless of socio-economic status.

1.2 NASHIK: THE PATH TO SUSTAINABLE MOBILITY

Nashik stands at a crucial point in its history, with the potential to become a thriving commercial and cultural center. However, realizing this potential requires robust infrastructure and services accessible to all residents.

Transportation infrastructure plays a vital role in shaping the city's identity and daily life. A well-designed transport system is essential for economic growth and the well-being of citizens. Sustainable transport, which considers social, economic, and environmental factors, is crucial for Nashik's prosperity. Inadequate transport planning can lead to congestion, pollution, and reduced productivity.This study advocates for transit-oriented development (TOD) as a framework for Nashik's growth. TOD integrates land use and transport planning, promoting walking, cycling, and public transit, enhancing connectivity, and encouraging mixed land use. By adhering to these principles, Nashik can create vibrant, compact neighbourhoods that reduce reliance on private vehicles and promote sustainable transportation modes.

Moreover, TOD presents an opportunity to address environmental concerns by reducing emissions, air pollution, congestion, and accidents. By prioritizing modes like walking, cycling, and public transit, TOD enhances mobility and creates safer, healthier urban environments.In summary, this study serves as a roadmap for Nashik's sustainable development, advocating for a transportation system that prioritizes citizen well-being and long-term prosperity. Embracing TOD principles can steer Nashik towards a more equitable, resilient, and environmentally friendly future.

2. Methodology

Survey Report

The survey report aims to comprehensively document the outcomes of the Traffic Volume Count conducted at major intersections along the BRT corridor of Aundh-Ravet road, situated within the jurisdiction of the Pimpri Chinchwad Municipal Corporation (PCMC). This endeavor forms an integral part of the broader BRTS study, which seeks to enhance the efficiency and sustainability of public transportation systems.

Survey Format and Method of Conduct

To ensure accuracy and reliability, the survey employed meticulously designed formats for classified traffic volume count and turning movement surveys. Each survey was conducted manually, with data collected at regular intervals to capture variations in traffic patterns throughout the day. The use of preform tally marks facilitated the systematic recording of

traffic volumes by direction and mode of transportation.

Passenger Car Units (PCU)

Standardizing vehicle volumes using Passenger Car Units (PCU), as per the guidelines outlined by the Indian Roads Congress, allowed for meaningful comparisons and analysis. By assigning PCU values to different vehicle types, ranging from two-wheelers to buses, the study achieved consistency in evaluating road capacity and traffic flow.

Vehicle	PCU Value
2 wheeler	0.5
Bus	3.0
Cycle	0.2
P. Bus	2.5
3 wheeler	1.5

Traffic Volume Study

Beyond mere numerical data, traffic volume studies serve multifaceted purposes in urban planning and management. They furnish invaluable insights into the relative importance of roads, aiding authorities in prioritizing infrastructure improvements and expansions. Moreover, these studies inform the planning and design of both existing and future transportation facilities, ensuring alignment with evolving mobility needs and traffic dynamics.

Traffic Volume Count

The meticulous manual counting process adopted for traffic volume assessment enabled a granular examination of vehicular movements. By recording not only total volumes but also vehicle classifications and turning movements, the study garnered a comprehensive understanding of traffic behavior. Statistical sampling techniques were employed judiciously to manage data collection efforts efficiently, balancing accuracy with practicality.

Data Collection

In addition to traffic-related parameters, the data collection scope extended to encompass broader urban development considerations. Insights into the sanctioned development plan of Nashik city, including land use allocations, road infrastructure provisions, and parking regulations, were incorporated into the study. These insights contribute to informed decision-making processes aimed at addressing emerging urban challenges such as congestion and pollution while fostering sustainable growth.

1. **Sanctioned development plan of Nashik city:** Land uses for various purposes, road width, and reservation from parking, future requirement for parking, D.C. rules and amendments for upcoming D.P. which is under progress.

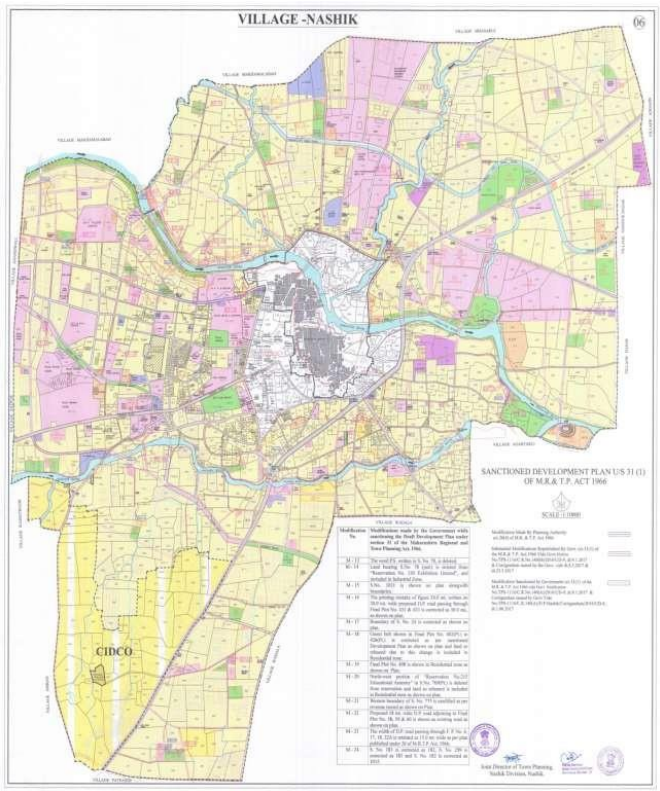

Figure 3.1 SANCTIONED DEVELOPED PLAN OF NASHIK CITY

2.Vehicle data from RTO :- Vehicle population for last 3 years and their growth in each year, so we can able to forecast for vehicular population for coming 10 years and also to different types of vehicle.

TRAFFIC COUNT SURVEY AT DWARKA

TABLE NO. 1

Officewise & categorywise Motor Vehicles populations as on 31'st March, 2012

Name of the Office :- RTO Nashik

Sr. No.	Category	M.V. Population as on 31-3-2007	M.V. Population as on 31-3-2008	M.V. Population as on 31-3-2009	M.V. Population as on 31-3-2010	M.V. Population as on 31-3-2011	M.V. Population as on 31-3-2012
1	2	3	4	5	6	7	8
1	Motor Cycles	319262	349141	382954	425898	479761	**541024**
2	Scooters	91452	97045	99775	103455	110279	**121751**
3	Mopeds	49216	49955	49668	49684	49786	**49920**
Total of Two Wheelers		**459930**	**496141**	**532397**	**579037**	**639826**	**712695**
4	Motor Cars	43351	49270	**55288**	63352	72624	**84675**
5	Jeeps	21827	23154	**23632**	22856	23089	**24682**
6	Station Wagons	91	91	**91**	93	93	**93**
7 (a)	Meter fitted	1663	1838	**1904**	1980	2091	**2101**
7(b)	Tourist cabs	1500	1538	**1595**	1847	2004	**2246**
8	Auto Rickshaws	22709	23241	**23524**	23844	23889	**23896**
9	Stage Carriages	822	826	**826**	826	926	**926**
10	Cont. Carriages/Mini bus	237	257	**321**	400	568	**827**
11	School Buses	210	231	**261**	287	297	**321**
12	Pvt. Service Vehicles	172	182	**196**	196	197	**203**
13	Ambulance	263	276	**309**	325	352	**404**
14	Arti. & Multi veh.	0	0	**5**	23	25	**34**
15	Trucks & Lorries	7834	8503	**8840**	9237	10009	**10427**
16	Tankers	404	432	**425**	446	520	**596**
17	Delivery Van (4 Whl.)	10829	11791	**12308**	13761	16399	**18857**
18	Delivery Van (3 Whl.)	4287	5420	**5866**	6456	6822	**7400**
19	Tractors (AGR)	27770	29611	**31492**	33998	37727	**41203**
20	Trailers	17872	18352	**20222**	21240	22561	**24510**
21	Trailers	0	0	**0**	0	352	**0**
22	Others	676	779	**816**	904	1074	
	Total	**622447**	**671933**	**720323**	**781098**	**861465**	**956096**

प्रादेशिक परिवहन अधिकारी

नाशिक

TABLE NO. 1

Officewise & categorywise Motor Vehicles populations as on 31'st March, 2018

Name of the Office - RTO Nashik

Sr. No.	Category	M.V. Population as on 31-3-2013	M.V. Population as on 31-3-2014	M.V. Population as on 31-3-2015	M.V. Population as on 31-3-2016	M.V. Population as on 31-3-2017	M.V. Population as on 31-3-2018	M.V. Population as on 31-3-2019
1	2	3	4	5	6	7	8	9
1	Motor Cycles	596009	653272	706848	762183	813610	**890887**	
2	Scooters	135811	152775	174007	199147	220142	**222237**	
3	Mopeds	50190	50555	51728	53591	54852	**56737**	
Total of Two Wheelers		**782010**	**856602**	**932583**	**1014921**	**1088604**	**1169861**	**0**
4	Motor Cars	97710	111809	**126209**	140897	155041	**171425**	
5	Jeeps	26552	26532	**26457**	26433	26380	**26380**	
6	Station Wagons	93	94	**94**	94	94	**96**	
7 (a)	Meter fitted	2101	2102	**2128**	2100	2095	**2095**	
7(b)	Tourist cabs	2406	2496	**2935**	3294	3671	**3993**	
8	Auto Rickshaws	19401	19693	**20836**	21496	21803	**22654**	
9	Stage Carriages	926	939	**950**	950	950	**950**	
10	Cont. Carriages/Mini bus	980	1129	**1195**	1383	1538	**1541**	
11	Scool Buses	480	570	**701**	761	945	**1382**	
12	Pvt. Service Vehicles	203	203	**203**	203	203	**205**	
13	Ambulance	476	532	**571**	618	641	**674**	
14	Arti. & Multi veh.	36	36	**36**	37	52	**52**	
15	Trucks & Lorries	11032	11490	**11890**	12385	12881	**17474**	
16	Tankers	752	782	**802**	836	839	**831**	
17	Delivery Van (4 Whl.)	22827	26143	**27815**	28759	30612	**30732**	
18	Delivery Van (3 Whl.)	8298	8972	**10259**	11928	13590	**14508**	
19	Tractors (AGR)	46365	52846	**59178**	64314	68996	**73893**	
20	Trailers	25192	25930	**26792**	28122	0	**43**	
21	Trailers	0	0	**0**	0	28738		
22	Others	5081	5343	**5613**	5761	5904	**6117**	
	Total	**1052921**	**1154243**	**1257247**	**1365292**	**1463577**	**1544906**	**0**

प्रादेशिक परिवहन अधिकारी

नाशिक

SALIENT FEATURES:

We conducted survey of Dwarka situated in Nashik the Dwarka circle junction is four arm intersection the surrounding area near Dwarka is full of traffic.

Figure 3.3 DWARKA CIRCLE, NASHIK

Dwarka circle is junction of:

- Four leg intersection
- Presently operated by traffic police

Sr. No.	Approaches	Lane Type
1.	Mumbai	4 - Lane divided
2.	Pune	4 - Lane divided
3.	Nashik City	2 - Lane divided

- Approach roads are given in the table below :

3.1.1 DATA ANALYSIS

The vehicular traffic is converted into PCU for analysis purpose using PCU factors given in IRC-106 as listed below in Table 4.1.

MODE	Equivalent Factors	
	Composition <5%	Composition >10%
2W	0.50	0.75
3W	1.2	2
4W	1.00	1.00
Mini Bus	1.4	2
Std. Bus	2.2	3.7
LCV	1.4	2
2-Axle Truck	2.2	3.7
3-Axle Truck	2.2	3.7
MAV	2.2	3.7
Tractor	4	5
Bicycle	0.40	0.50

Table 3.3 PCU Factor

The volume count is converted into PCUs by using its equivalency factor given in IRC-106. If the composition is between 5%-10% than PCU factor is calculated using interpolation. The traffic count for all movements is shown below in Table

3.1.2 ORIGIN-DESTINATION (O-D) SURVEY:

The origin & destination (O & D) study determines the number of vehicular traffic, their origins & destinations in each zone under study .The data may also be supplemented by the number of passengers, purpose of each trip, intermediate stops made & reasons etc. Origin & destination study gives information like the actual direction of travel, selection of routes & length of the trip. The O & D studies are most essential in planning new highway facilities & in improving some of the existing systems. As an example there may be a high percentage of through traffic which may be diverted by providing a bye-pass& this considerable saving in distance& time can be made. O & D study provides the basic data for determining the desired flow or the desire lines. This is considered to be one of the important traffic studies needed to solve many traffic problems in a zone & the most important study to plan the highway system in a region. Also future needs may be estimated by extrapolating the data from O & D study.

The various applications of O & D studies may be summed up as follows:

- To locate expressway or major routes along the desired lines.
- To establish preferential routes for various categories of vehicles including bye-passes.
- To judge the adequacy of existing routes & to use in planning new network of roads.
- To locate terminals & to plan terminal facilities.
- To locate new bridges are per traffic demands.
- To establish design standards for the road, bridges & culverts along the route.

There are number of methods for collecting the O & D data. Some of methods commonly adopted are:- Road-side interview method, License plate method, Return post card method, Tag-on- car method, Home interview method. The choice of the method is made judiciously depending on the objective & location.

Figure 3.4 ORIGIN SURVEY AT SHALIMAR CHOWK

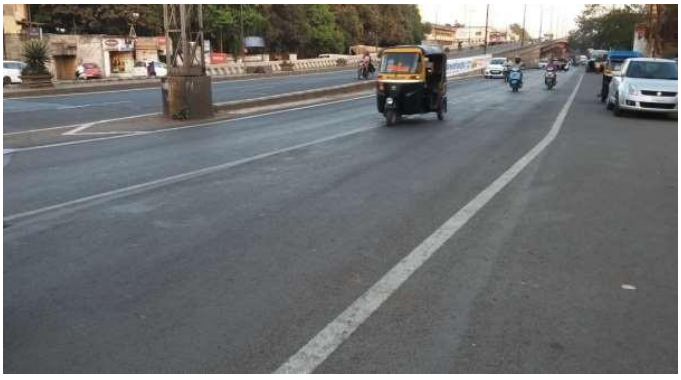

Figure 3.5 DESTINATION SURVEY AT NASHIK ROAD

BRT Operations and Routing

The operation and routing of Bus Rapid Transit (BRT) systems are categorized into three main types:

1. **Trunk-Only (Closed Systems):** These systems operate exclusively along dedicated lanes, with BRT buses running solely on designated routes. Examples include Jakarta, Ahmedabad, Beijing, Xiamen, and Istanbul. While regular buses and minibuses may feed into stations, they are operated separately by private operators.
2. **Trunk-Feeder:** In Latin America, trunk-feeder systems are prevalent, where BRT buses primarily operate on main routes but also serve as neighborhood distributors at certain points. Cities like Bogotá, Curitiba, Mexico City, and Lima adopt this model, with feeder services complementing the main BRT lines.
3. **Direct-Service (Open Systems):** Many Chinese cities, such as Guangzhou, Dalian, and Hangzhou, implement open systems where buses have the flexibility to enter and exit dedicated lanes, integrating line-haul and feeder services. This approach allows for a mix of regular and express services, accommodating diverse travel patterns efficiently.

Advantages of BRT Systems:

- BRT systems offer flexibility and versatility, catering to evolving urban travel needs.
- They can provide seamless, one-seat rides without the need for transfers, especially beneficial in suburban areas with dispersed travel patterns.
- Unlike rail systems, BRT can incorporate off-line stations, allowing buses to access major destinations directly.
- Express and local services within BRT corridors optimize efficiency, adapting to varying passenger demands effectively.

- **Fare Collection and Enforcement in BRT Systems**

- BRT systems commonly implement flat fares, with only a few opting for distance-based or zonal pricing models. This approach ensures affordability, often undercutting informal or quasi-private operators' charges. For instance, Bogotá offers a day pass for around one US dollar. Despite the reasonable fares, Latin American BRT systems minimize reliance on operating subsidies, thanks to their higher ridership productivity levels.

- Pre-board fare collection and verification are prevalent in Latin American, Asian, and French BRT systems, whereas U.S. and European counterparts favor pre-paid ticketing with barrier-free, proof-of-purchase inspections.

- However, fare evasion persists in many BRT systems, particularly in developing cities with a large low-income, transit-dependent population. Santiago's Transantiago BRT system faces an average fare evasion rate of 27.7 percent, stemming from a transition from a fragmented, privately operated system to a formal public system. This shift led to a decline in service quality, prompting the government to pay operators based on anticipated rather than actual demand, exacerbating operational challenges.

- Inadequate public transport infrastructure, as observed in the Shalimar area of Nashik, exacerbates congestion and pollution, driving reliance on personal vehicles. Sustainable traffic management strategies, including dedicated BRT lanes, pedestrian footpaths, and cycle tracks, are crucial for promoting efficient, environmentally friendly urban mobility and fostering sustainable development.

Conclusion :

Affordable Access: Flat fares in BRT systems ensure accessibility for passengers, often offering more economical options compared to informal transportation services.

- **Operational Efficiency:** Pre-board fare collection and verification streamline operations, particularly in Latin American, Asian, and French BRT systems, optimizing passenger flow and revenue collection.
- **Challenges of Fare Evasion:** Despite efforts, fare evasion remains a persistent challenge in many BRT systems, particularly in regions with low-income, transit-dependent users, impacting revenue streams and operational sustainability.
- **Impact on Service Quality:** Transitioning from fragmented, privately operated systems to formalized BRT networks can sometimes lead to service deterioration, as observed in cases like Santiago's Transantiago, highlighting the importance of effective governance and oversight.
- **Importance of Sustainable Urban Mobility:** Enhancing public transport infrastructure, including dedicated BRT lanes and pedestrian-friendly amenities, is crucial for mitigating congestion, reducing pollution, and promoting sustainable development in urban areas.

4. REFERENCES

1. Highway Engineering by S. K. Khanna and C. E. G. Justo.

2. International Journal on Recent and Innovation Trends in Computing and Communication Volume: 4 Issue: 4 Sustainable Urban Transport Management for Nashik City.

3. Transportation in mega cities local issues, a global question by Naba Taiyab

4. Maharashtra state Road Transportation Corporation(MSRT): https://msrtc.maharashtra.gov.in